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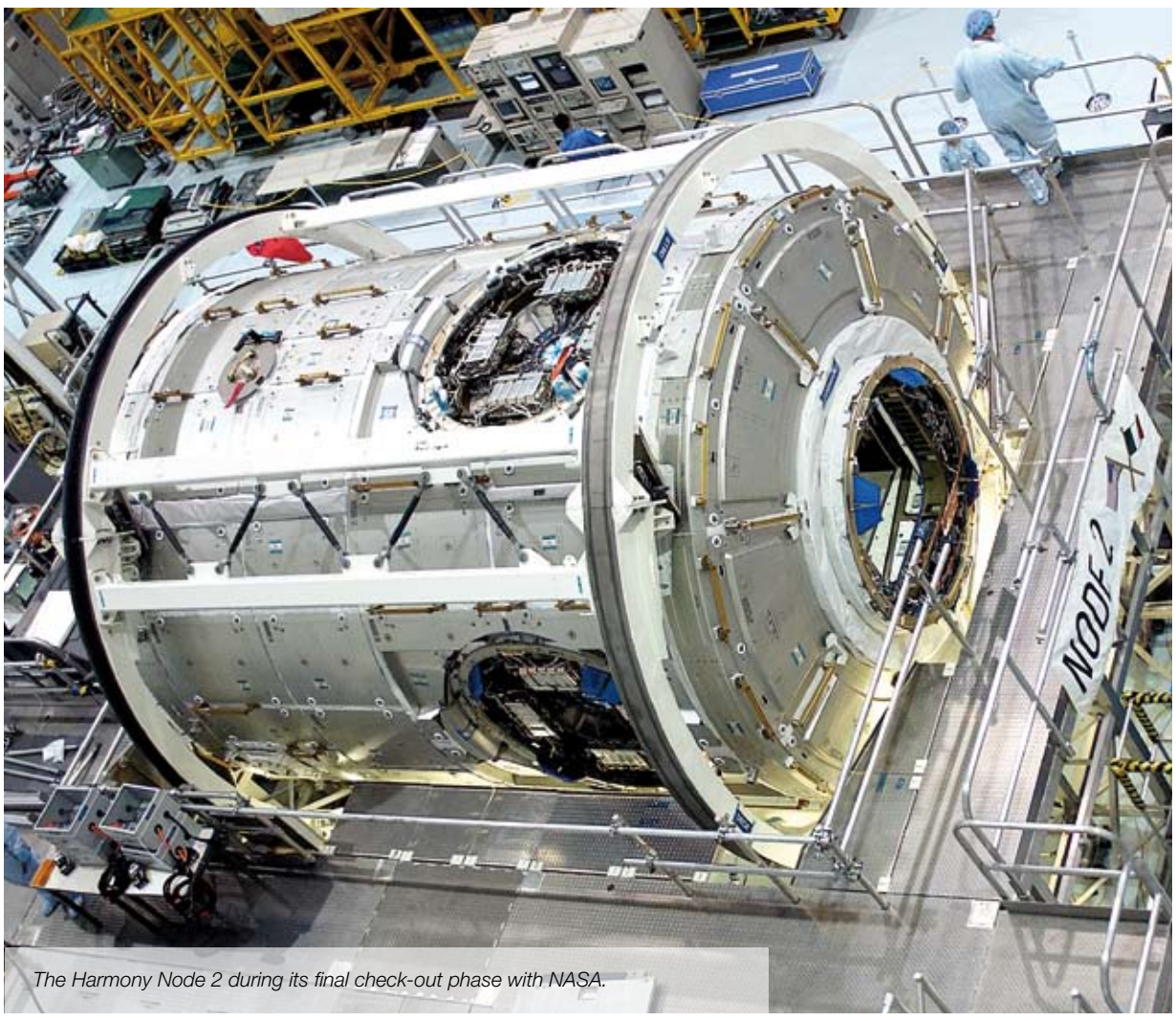


The Harmony Node 2 during its final check-out phase with NASA.

ESA astronaut oversees delivery of ISS 'gateway'

Italian ESA astronaut Paolo Nespoli has trained hard for his role on a Space Shuttle mission to deliver and attach a European-built interconnecting node to the International Space Station (ISS).

The Node 2 'Harmony' will be carried into orbit in the payload bay of Discovery and once installed will become an international gateway to the ISS, linking the European, American and Japanese modules as well as having a docking port for visiting spacecraft.

The flight opportunity for Nespoli stems from the visionary involvement of ASI in providing three pressurised cargo containers – Multi-Purpose Logistics Modules (MPLMs) – to NASA under a bilateral agreement. As a result ASI obtained six flight opportunities and further close cooperation with ESA led to the assignment of Nespoli, an Italian member of the European Astronaut Corps, to the STS-120 mission.

For his first and long-awaited spaceflight, Nespoli serves as a mission specialist, joining six NASA astronauts on the STS-120 Space Shuttle flight.

His mission is another important space milestone for ESA, enhancing practical and operational expertise in readiness for the Columbus laboratory, and helping promote human spaceflight activities across Europe.

Node 2 is a pressurised module which, along with Nodes 1 and 3, interconnects the research, habitation, control and docking modules of the Space Station. The nodes are also used to control and distribute resources between the connected elements.

Nespoli, an Italian ESA astronaut since 1998, has trained intensively for a role that will see him assume overall responsibility for coordinating three of the mission's four complex spacewalks which are necessary to attach Harmony to the ISS and reposition a solar array.

He will organise activities from inside Discovery, directing the spacewalkers and liaising closely with ground controllers and with the Shuttle and Station robotic arm operators.

Until Harmony is in place there is nowhere to attach the international partner modules – it is an essential piece of the jigsaw piece that makes the rest possible.

Harmony was built for NASA under a barter agreement with ESA and the Italian space agency (ASI) in exchange for the launch of the European Columbus laboratory by the Space Shuttle to the ISS.

Nespoli's other responsibilities on the 14-day mission will include conducting a joint ESA/ASI programme of human physiology and biology experiments, and assisting with the maintenance and operation of Discovery's onboard systems.

Paolo Nespoli during training for his mission to the Space Station to install Harmony.

Connecting device is crucial part of ISS expansion

In early 2007 NASA held a competition amongst schoolchildren in the United States to find a name for the Italian-built Node 2 module – and as a result it was named 'Harmony'.

Node 2 was designed and built by Thales Alenia Space, Italy, as part of the Columbus launch barter agreement between NASA and ESA, and a follow-on agreement between ESA and the Italian space agency (ASI).

The structural design is based on that of the Multi-Purpose Logistics Module (MPLM). ASI has built and delivered three MPLMs to NASA, which are launched with the Shuttle to deliver cargo to the ISS.

The installation of the Harmony node – which measures 6.7 m long and has a diameter of 4.5 m – increases the living and working space inside the Space Station to approximately 500 cubic metres.

Discovery will be docked to an existing adapter port where the node is meant to attach, so to start with Harmony will be installed in a temporary spot on the first connecting node, Unity.

Subsequently, the Shuttle crew will continue to set up the Station's exterior support truss and its power system.

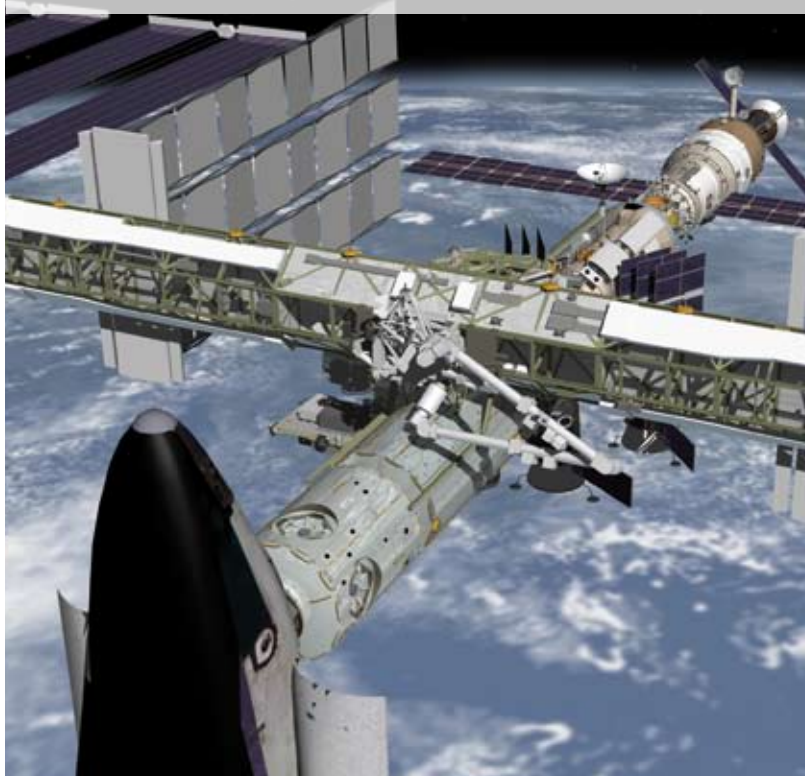
Work will then shift to moving a truss segment that holds the Space Station's original set of solar arrays to a new home.

The P6 arrays, as they are known, have been attached to the middle of the truss for the past seven years, positioned vertically to the rest of the Station, where they have acted as a temporary power system.

With the addition of two sets of arrays brought to the Space Station on recent Shuttle flights, the original arrays can be relocated during STS-120's mission to their permanent position at the very end of the left side of the truss.

Once Discovery has departed the ISS, crew members will transfer Harmony to its new and permanent home, the American laboratory Destiny, ready to welcome the European space laboratory Columbus.

Artist's impression of a Space Shuttle docked to Harmony.



Showcase for European technology

The name chosen for Paolo Nespoli's mission by ESA and the Italian space agency (ASI) is 'Esperia' which originates from the ancient Greek name for the Italian peninsula.

Nespoli's Shuttle mission to the International Space Station (ISS) is a showcase for European technology.

"The first European-built node to be launched is of crucial importance for the future of the ISS," said Daniel Sacotte, ESA's Director of Human Spaceflight, Microgravity and Exploration.

The Esperia logo was designed by Italdesign S.p.A under a sponsorship agreement with ASI. "The comet represents the Space Shuttle cruising in space on its journey to the Space Station establishing a strong and long-lasting tie," said logo designer Giorgetto Giugiaro.

It depicts how the mission is key to completing ISS assembly and also how it marks a step forward along the path of further exploration of space.

"Italy is one of the main European players in space activities," said Simonetta di Pippo, Director for ASI's space science and exploration programme.

"As the name suggests, the Esperia mission is an example of Italy's long-term commitment to space exploration, and of our vision and ambition for the future.

"It is also one more example of Italian industrial capabilities on which we rely to confirm our investments in European space programmes, in particular the Aurora exploration programme."

Tough training regime for complex mission

By the time launch day arrives, ESA's Italian astronaut Paolo Nespoli and his six NASA colleagues on the Space Shuttle will have been on mission-specific training for well over a year.

Thorough and detailed preparation and, of course, a little good fortune along the way is important in making the vital flight a success.

As well as the safe delivery of the Node 2 connecting module, the STS-120 mission will exchange a member of the Space Station's permanent crew and undertake the challenging operation of repositioning a set of solar arrays.

Nespoli's main task will be to coordinate three out of a total of four spacewalks necessary to attach Node 2 to the ISS and reposition a solar array panel.

During his first ever launch into space Nespoli will be strapped in Discovery's middeck area.

The journey into space from the launch pad in Cape Canaveral, Florida, takes only eight minutes and 20 seconds, by which time the Space Shuttle has reached a height of 220 km and a speed of 7.87 km/s.

The first day in space finishes with a few hours of hard work for Nespoli as he and his crewmates convert the Space Shuttle from a launch rocket into a home were they will work and live for the next 14 days.

"As soon as we arrive in orbit the frantic pace picks up and I am responsible for configuring all of the middeck area. This takes about four or five hours," he explained.

But his responsibilities are not these alone. Next day, for some of the crucial inspection of the Shuttle's heat shield following launch, Nespoli will be at the controls of the orbiter's robotic arm, and then he will check and prepare the spacewalkers' suits. The following day he will be part of the four member team that performs the approach and docking with the Space Station.

"Everybody says that from a planning and operational point of view this is probably the most complex mission in the history of the Space Shuttle programme," he explained.

"For instance, when it comes to repositioning the P6 solar array, there is a limited amount of time from the moment the spacewalkers detach the electrical connections to when these need to be reconnected. During this period, the solar array needs to be moved all the way down to the end of the truss.

"That's a long way to go and the Station's robotic arm cannot do it itself because it cannot stretch all the way – so, after having removed P6 from the top of the station, it has to temporarily 'hand it over' to the Shuttle arm so that it can reposition itself on another basepoint and then re-grapple P6 and finally take it all the way at the end of the truss, were the spacewalkers will reconnect it to the Station's command and control system.

"All of this will take 48 hours and if we don't manage to do it properly, the solar array will freeze and won't be usable any more."

Because of the complexity and connected nature of the spacewalks, NASA decided this time that it would be better to have a single crew member to oversee them all.

"Of course, I would have preferred to be outside doing a spacewalk," said Nespoli. "But for this time I will be inside coordinating the work of all the others.

The STS-120 crew. Pictured (from left) are: Scott Parazynski, Douglas Wheelock, Stephanie Wilson, George Zamka, Pamela Melroy, Daniel Tani and Paolo Nespoli.

There is a lot of responsibility associated with this, since it will be my task to make sure that everything is done precisely according to the timeline."

As the mission draws to a close, Nespoli will be part of the team that will execute the Shuttle undocking activities and, for the re-entry and landing phase, he will sit on the flight deck monitoring systems for the Shuttle's commander and pilot.

Joint ESA/ASI experiment programme

The complex nature of the STS-120 Space Shuttle mission means that for Paolo Nespoli there will only be limited time to carry out scientific experiments.

"We wanted to take advantage of the fact of having a European astronaut on board Discovery to carry out some science experiments and education activities," explained Nespoli.

"But we ran into the problem that a Shuttle has little spare storage capacity on a mission like this – everything is full up and our timeline is also already very tight.

"Nevertheless, we were able to include a few experiments from both ESA and the Italian space agency (ASI). So there will be a little bit of science that will be done."

Two of these experiments (Chromosome-2 and Neocytolysis) are sponsored by ESA, the other three (HPA, FRTL-5 and SPORE) are sponsored by ASI. Chromosome-2, Neocytolysis and HPA are in the field of human physiology, whilst FRTL-5 and SPORE are biology experiments.

> Chromosome-2

Far above the protection of Earth's atmosphere, orbiting astronauts are inevitably exposed to higher doses of radiation and to study what effect this might have at a chromosome level blood samples are taken from an astronaut before and immediately after a flight.

> Neocytolysis

The experiment will analyse the physical and functional characteristics of young red blood cells taken from astronaut blood samples before and after spaceflight.

> SPORE

The experiment was conceived by Italian high school students to study the effect of weightlessness and ionising radiation on the survival and development of bacterial spores.

> Hand Posture Analyser (HPA)

Equipment for measuring astronaut pinch and grip force, and hand movement. The experiment data will be useful for countering fatigue in astronaut upper limbs. A preliminary version of the same hardware was already used in 2002 by Italian ESA astronaut Roberto Vittori during his Marco Polo mission to the ISS.

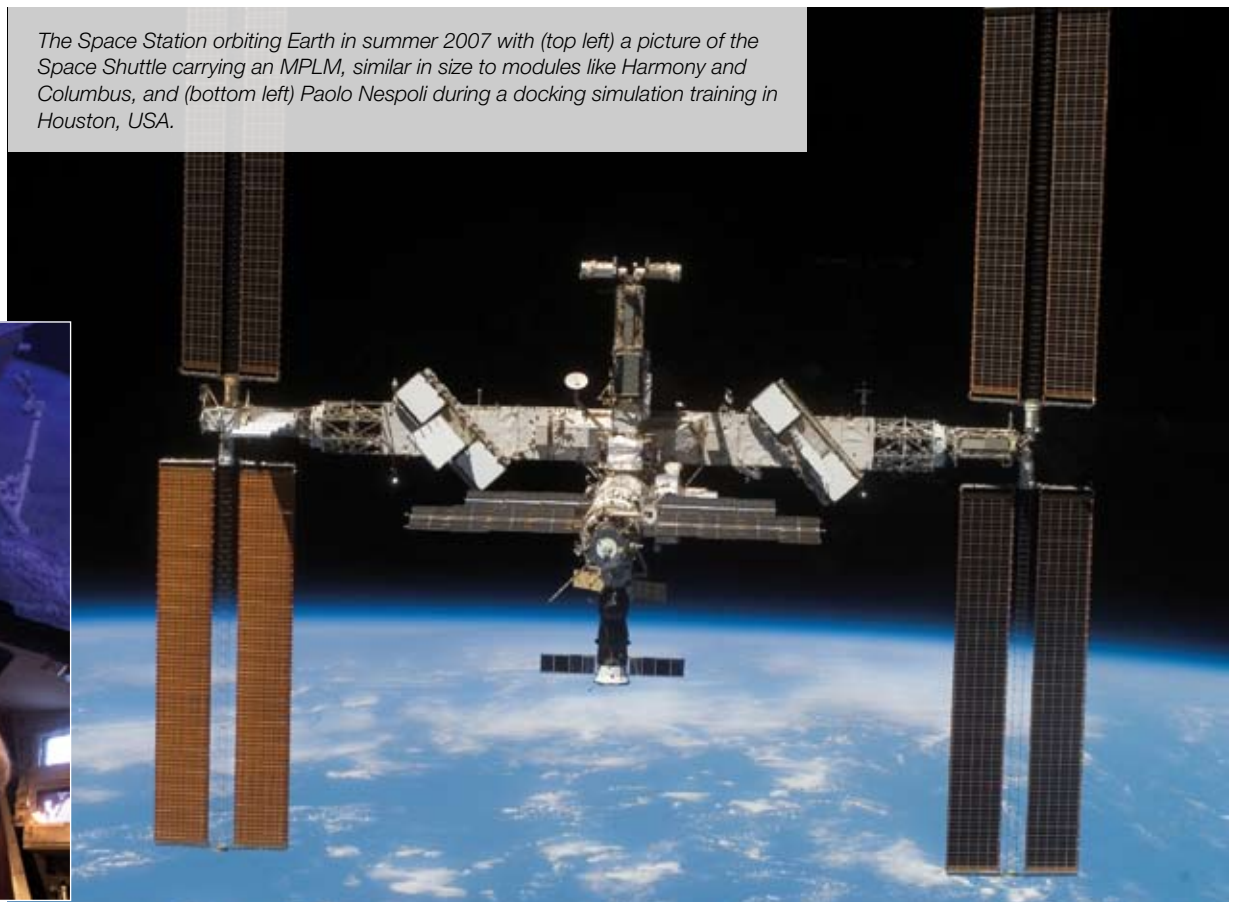
> Fischer Rat Thyroid Low serum 5 (FRTL5)

Aimed at assessing the effects of the space environment on rat thyroid cells, this experiment will use cells already exposed to the space environment during ESA's Eneide mission in 2005. The study will be applied to human physiology and medicine.

> ARISS and other education activities

Nespoli will also be involved in a number of education-based activities coordinated by ESA and ASI. During two live ARISS (Amateur Radio on the International Space Station) radio contacts with the ISS, he will answer questions from students at the IIS Deambrosis-Natta school in Sestri Levante, Genoa, and the University of L'Aquila. A web-chat with Nespoli is also foreseen, as well as the distribution of education material about the mission addressing youngsters in Italy. ESA will also publish a web lesson about radiation for European secondary school teachers.

The Space Station orbiting Earth in summer 2007 with (top left) a picture of the Space Shuttle carrying an MPLM, similar in size to modules like Harmony and Columbus, and (bottom left) Paolo Nespoli during a docking simulation training in Houston, USA.



Raising the profile of space

Paolo Nespoli, born in Milan, Italy, in 1957, is a professional engineer, private pilot with instrument rating, advanced scuba diver and Nitrox diver, as well as being a freefall parachutist and special forces operator.

A member of the European Astronaut Corps since 1998, he naturally looks forward to finally fulfilling a dream. "I will reach a goal I have been working on for many many years, so I am looking forward to experiencing this personally," he said.

Nespoli added that missions such as this raise dramatically the awareness for space of both politicians and the general public.

"I believe it is important for students to realise that being an engineer, a physicist, or a scientist can also be fun," he said.

"Of course, to help with this my mission will include a number of educational activities. There will be amateur radio contacts with schools in Italy and two live video conferences from the Space Station are planned.

"I hope in some way my mission will serve as a focus for crystallising the attention of the public."

The Italian Ministry of Social Solidarity is also supporting the Esperia mission and will carry out a series of activities, in particular with Italian schools, to promote Nespoli's mission to all citizens.

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